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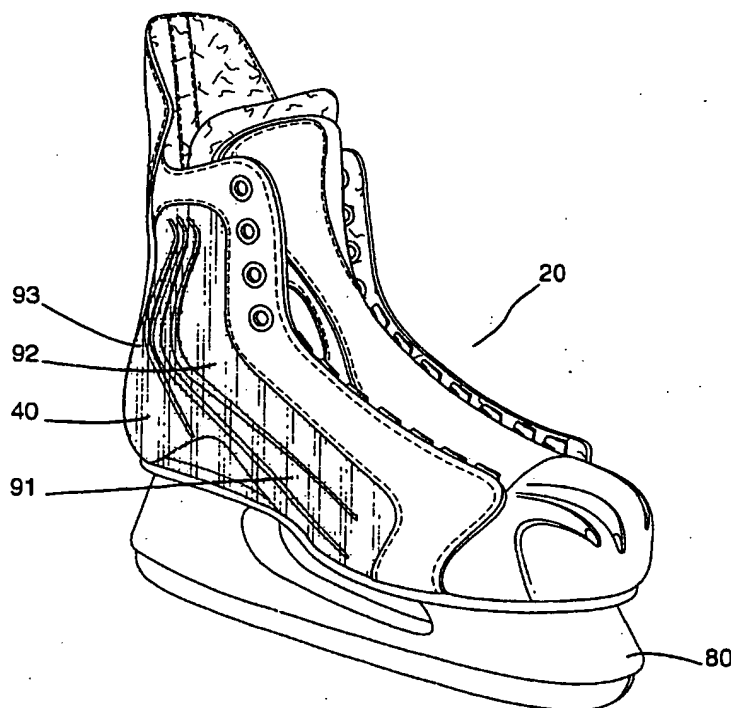
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(57) Abrégé/Abstract:

A skate boot for ice skate or in-line roller skate comprising an upper having portions thereof made of compressed foam material. In a preferred embodiment, the skate boot is constructed with two preformed quarter panels made of compressed foam material having wherein the inner surface of each panel is shaped to substantially conform to the anatomical shape of a corresponding side of the human foot. Such a construction provides a skate boot, which is comfortable, long lasting, and exhibits flexibility and support. Such a construction also provides added flexibility to the skate designers to vary the dynamic properties of the skate and also the ornamental features of the skate. A method of making such a skate boot is also disclosed.



## **SKATE BOOT**

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### **Field of the invention**

The invention relates to a skate boot such as used for ice skates or in-line roller skates and more particularly to a skate boot construction.

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### **Background of the invention**

Typical skate boots are fabricated by assembling together previously die-cut pieces of textile material and shaping them over a last. Various pieces of textiles  
15 or fabrics are cut to specific patterns, which are then pre-assembled by stitching or gluing or both into a multi-layer construction. The rigidity and flexibility characteristics of the skate boot are defined by the various layers of materials being positioned and layered in specific regions of the pre-assembled component of the skate boot. The accumulation of pieces of material into layers  
20 and the mechanical properties of each piece of textile or fabric material define the overall dynamic behavior of the skate boot. Usually, the pre-assembled component further includes rigid components generally made of plastic to increase the rigidity of specific area of the skate boot. The pre-assembled boot generally consists of the back and sides of the skate boot and a toe cap and  
25 tongue assembly. The pre-assembled boot has the general configuration of the finished product but has not yet been shaped to the final form of the skate boot.

The pre-assembled component is positioned over a last and formed to obtain the shape of the desired finished product. A last is a three-dimensional shape of the  
30 inside cavity of a boot. The pre-assembled boot may be mounted upside down

onto the last for ease of manipulation and assembly of the remaining components making up the skate boot. An insole is placed on the top part of the upside down last and the pre-assembled boot is stretched over the last and over the insole in order for the pre-assembled boot to conform to the specific shape of the last. The stretched material is then glued and nailed or tacked to the insole to maintain the desired shape. Once the upper part of the skate boot is completed, a rigid outsole is glued to the insole of the boot to complete the skate boot. An ice blade holder or an in-line roller chassis is finally mounted to the bottom of the boot to complete the skate.

10 This type of process is extensively used in the shoemaking industry. It generates a good product but has some disadvantages. For instance, the number of parts involved in the multi-layer construction can be staggering; a conventional ice skate for hockey may have up to eighty parts to be assembled and shaped over the last. As a consequence, the manufacturing process is lengthy and complex. The nature of the assembly of parts is inherently labor intensive and slow as there are many manual tasks to be performed and many steps are necessary to complete the footwear. The considerable number of elements to be assembled entails an increased risk of errors, particularly in the alignment of the various pieces of the pre-assembled boot, which contributes to an increase in the number of rejected boots or skates in the manufacturing process or at least, a reduction in the quality of the overall production. This traditional process of making skate boot also requires several molds and cutting dies to produce all the pieces necessary for making the pre-assembled boot.

25 In an effort to reduce the number of components used to make a skate boot, these are sometimes made of an exterior plastic molded shell. However, skate boots made of molded plastic tend to be stiff and /or cumbersome, do not perform as well as traditionally made skate boots and for that reason, have not found wide acceptance amongst professional hockey players. U.S. Patent No.

4,509,276 to Bourque discloses a skate boot made of a combination of plastic and fabric material. The skate boot disclosed consists of a lower exterior molded rigid plastic portion and intermediate and upper portions made of pliable material to allow forward flexure and torsional flexibility in the ankle area.

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These designs effectively reduce the number of components utilized in the manufacturing process of a footwear or skate. However, the end product is usually stiffer than a traditionally made skate boot and represents a compromise in the area of performance.

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Thus there is a need in the industry for a skate boot made of fewer components than the traditionally made skate boot yet provides a skate boot that performs as well as a traditionally made skate boot.

15 Furthermore, skates using typical skate boots made of conventional textile or fabric materials using the conventional lasting method perform well for some time but have a tendency to develop creases around the ankle area and deteriorate over time. The material used in the making of a typical skate boot deteriorates with time and eventually fails to provide the adequate support necessary for  
20 optimal skating performance. Conversely, skates having skate boots made of molded rigid plastic may not wear out as quickly as skates using typical skate boots but they do not provide the flexibility of a typical skate boot.

Thus there is also a need for a skate, which provides flexibility and durability as  
25 well as optimal performance.

#### **Objects and statement of the invention**

It is thus an object of the invention to provide a skate boot made of fewer  
30 components than a traditionally made skate boot.

It is another object of the invention to provide a skate boot having elastic dynamic behavior.

- 5 It is another object of the invention to provide a skate which provides flexibility and durability.

It is another object of the invention to provide a skate boot construction which is less labor intensive and more cost effective to build than a traditionally made  
10 skate boot.

It is another object of the invention to provide a method of making a skate boot, which is more cost effective than the traditional method.

- 15 As embodied and broadly described herein, the invention provides a skate boot having an upper for enclosing and supporting a human foot. The upper comprises:

- a heel counter for surrounding the sides and back of the heel portion of a human foot;
- 20 -an ankle support for surrounding and supporting the ankle region of a human foot;
- a medial quarter and a lateral quarter for enclosing each side of a human foot, each quarter having a frontal edge, the medial and lateral quarters extending forwardly from the heel counter and the ankle support. The  
25 quarters define respective medial and lateral side of said skate boot;
- bridging means for joining said quarters together at the heel counter and the ankle support;
- an insole forming the bottom of the upper;
- a toe box for covering the toe area of the human foot, which is connected  
30 to the frontal edges of the lateral and medial quarters;

-a tongue extending upwardly and rearwardly from the toe box for covering the upper frontal part of the human foot and ankle; and  
-a rigid outsole defining the under side of the skate boot;  
-wherein at least one of the lateral and medial quarters consists of a  
5 preformed molded panel made of foam material having an inner surface and an outer surface wherein the inner surface of the panel is shaped to substantially conform to the anatomical shape of a corresponding side of the human foot.

10 Preferably, each said lateral quarter and medial quarter consists of a preformed molded panel made of foam material having an inner surface and an outer surface wherein the inner surface of said panel is shaped to substantially conform to the anatomical shape of a corresponding side of the human foot.

15 Advantageously, the outer surface of the preformed molded panel comprises a protective textile overlay made of synthetic material resistive to abrasion and cutting.

As embodied and broadly described herein, the invention further provides a  
20 skate boot having an upper for supporting and enclosing a human foot, the upper comprising:

-a heel counter for surrounding the sides and back of the heel portion of a human foot;  
-an ankle support for surrounding and supporting the ankle region of a  
25 human foot;  
-a medial quarter and a lateral quarter for enclosing each side of a human foot, each quarter having a frontal edge, the medial and lateral quarters extending forwardly from the heel counter and the ankle support. The quarters defining respective medial and lateral side of the skate boot;  
30 -an insole forming the bottom of the upper;

- a toe box for covering the toe area of the human foot, which is connected to the frontal edges of the lateral and medial quarters;
- a tongue extending upwardly and rearwardly from the toe box for covering the upper frontal part of the human foot and ankle; and
- 5 -a rigid outsole defining the under side of said skate boot;
- wherein at least a substantial portion of the upper comprises a preformed molded element made of thermo-formable foam material shaped to a definitive shape.

- 10 As embodied and broadly described herein, the invention further provides a method of making a skate boot comprising the steps of:
- (a) forming a foam quarter panel by molding a sheet of foam material;
  - (b) assembling to said foam quarter panel, a rear cover, an inner lining, an insole, a toe box and a tongue to form a skate boot upper; and
  - 15 (c) affixing an outer sole to the under side of said skate boot upper.

In a preferred embodiment of the method, two foam quarter panels are formed by molding sheets of foam material, one medial foam quarter panel and one lateral foam quarter panel, said foam quarter panels being assembled together

20 at the rear prior to the step of assembling to said foam quarter panels, a rear cover, an inner lining, an insole, a toe box and a tongue to form a skate boot upper. The skate boot upper preferably includes a lower skirt wherein the preferred embodiment of the method further comprising the steps of:

- (i) positioning said skate boot upper over a last;
- 25 (ii) shaping over the last said skate boot upper by folding said lower skirt of said upper underneath said insole and fastening said skirt to said insole;

prior to affixing an outer sole to the under side of said skate boot upper.

Preferably, the step of forming a foam quarter panel by molding a sheet of foam material comprises the steps of:

- (a) positioning the sheet of foam material into a male-female mold and closing the mold;
- 5 (b) applying heat and pressure to the sheet of foam material;
- (c) thermoforming at least a portion of the sheet of foam material to the shape of the male-female mold;
- (d) cooling the portion of the sheet of foam material in a compressed state so that the portion of the sheet of foam material sets in the shape of the
- 10 male-female mold; and
- (e) opening the male-female mold and removing the molded foam quarter panel from the mold.

Other objects and features of the invention will become apparent by reference  
15 to the following description and the drawings.

#### **Brief description of the drawings**

A detailed description of the preferred embodiments of the present invention is provided herein below, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view illustrating a preformed molded quarter panel for a skate boot according to an embodiment of the invention;

Figure 2 is a perspective view illustrating the preformed molded quarter panel of Figure 1 with an added protective overlay according to an embodiment of the invention;



Figure 3 is a cross-sectional view of the preformed molded quarter panel taken at line 3-3 of Figure 2 according to an embodiment of the invention;

Figure 4 is a perspective view illustrating a mold for forming the quarter panels according to an embodiment of the invention;

Figure 5 is a perspective view illustrating a sheet of foam material;

Figure 6 is a perspective view illustrating a sheet of foam material with an additional foam element;

Figure 7 is a perspective view illustrating the lateral and medial preformed molded quarter panels assembled together according to an embodiment of the invention;

Figure 8 is a rear elevational view of the assembled lateral and medial preformed molded quarter panels according to an embodiment of the invention;

Figure 8a is a cross-sectional view of the preformed molded quarter panel taken at line 8a-8a of Figure 8 according to an embodiment of the invention;

Figure 8b is a cross-sectional view of the preformed molded quarter panel taken at line 8b-8b of Figure 8 according to an embodiment of the invention;

Figure 8c is a cross-sectional view of the preformed molded quarter panel taken at line 8c-8c of Figure 8 according to an embodiment of the invention;

Figure 8d is a cross-sectional view of the preformed molded quarter panel taken at line 8d-8d of Figure 8 according to an embodiment of the invention;

Figure 9 is a perspective view illustrating the preformed quarters of the upper with an inner lining installed, lace eyelets and loops, and various external pieces added according to an embodiment of the invention;

Figure 9a is a perspective view illustrating the upper having a variant of a preformed quarter panel according to a second embodiment of the invention;

Figure 9b is a perspective view illustrating the upper having a variant of a preformed quarter panel according to a third embodiment of the invention;

Figure 9c is a perspective view illustrating the upper having a variant of a preformed quarter panel according to a fourth embodiment of the invention;

Figure 10 is a rear elevational view of the upper of Figure 9;

Figure 10a is a rear elevational view of the upper of Figure 9a;

Figure 10b is a rear elevational view of the upper of Figure 9b;

Figure 10c is a rear elevational view of the upper of Figure 9c;

Figure 11 is a perspective view illustrating the upper with a toe box and tongue installed according to an embodiment of the invention;

Figure 12 is a perspective view illustrating the lasting process of folding the lower skirt and positioning the insole according to an embodiment of the invention;

Figure 13 is a perspective view illustrating the completed upper according to an embodiment of the invention;

Figure 14 is a perspective view illustrating an ice skate according to an embodiment of the invention; and

Figure 15 is a perspective view illustrating an in-line roller skate according to an embodiment of the invention.

In the drawings, preferred embodiments of the invention are illustrated by way of examples. It is to be expressly understood that the description and drawings are only for the purpose of illustration and are an aid for understanding. They are not intended to be a definition of the limits of the invention.

#### **Detailed description of preferred embodiments**

A skate boot manufactured in accordance with the present invention is illustrated generally by reference numeral 20 in Figure 13. Skate boot 20 preferably includes an upper 21 having a heel counter 23 which cups around the wearer's heel, an ankle support 25 enclosing a substantial portion of the wearer's ankle, a lateral preformed molded quarter panel 22 and a medial preformed molded quarter panel 24 extending along each side of the wearer's foot and ankle, and a tendon guard 27 secured to the upper edge of ankle support 25 or made integral therewith. Skate boot 20 further includes an inner lining 26 which is a layer of soft material covering the inside walls of skate boot 20 or at least a portion thereof. Skate boot 20 also includes a cushioning tongue 28 and a toe box 30. Skate boot 20 is completed with an outsole 32 covering the bottom portion of upper 21. In accordance with one embodiment of the invention, preformed molded quarter panels 22 and 24 are molded from a foam material prior to assembly into upper 21. Outsole 32 is molded from a rigid plastic and mounted to the bottom surface of upper 21 with adhesive or nails, preferably both.

Figure 1-3 illustrates an exemplary embodiment of a lateral preformed molded quarter panel 22; a medial preformed molded quarter panel 24 being constructed in a similar fashion although not being an exact mirror image of lateral preformed molded quarter panel 22. The two panels 22 and 24 are shaped to conform to the exterior and interior contour of the foot. As shown in Figures 1 to 3, lateral foam quarter panel 22 is a preformed three-dimensional one-piece component. It comprises a peripheral thin region 36, which makes up the periphery of upper 21 as well as the rear and tendon guard area of upper 21. Lateral foam quarter panel 22 also comprises a flexible skirt 38 located on its lower edge, and a central portion 40 having variations of thickness. Central portion 40 being thicker than the rest of quarter panel 22 is not as easily bent as the peripheral region and as such provides rigidity and structure to skate boot 20. In this embodiment, central portion 40 further comprises an array of ribs 42, which may serve to increase the rigidity of quarter panel 22 by adding more thickness locally. Ribs 42 may also serve simply as decorative elements.

The interior surface 34 of lateral foam quarter panel 22 has approximately the same shape and configuration of a human foot. Once assembled, it defines the interior shape of skate boot 20. The interior surface 34 of preformed quarter panels 22 and 24 is taken from a three dimensional model of the foot and ankle morphology of a typical human foot which accounts for statistical variations of the relative position of the lateral and medial malleolus within a specific size range. As shown in Figure 3, which is a cross-sectional view of preformed quarter panel 22 taken at line 3-3, the interior surface 34 is smooth and is adapted to conform to the general morphology of a human foot in order to provide a comfortable contacting surface between skate boot 20 and the foot.

The molded foam quarter panels are manufactured one-piece components produced by thermo-pressured molding of a suitable thermosetting foam material initially in uniform thickness sheet form such as a pre-cut sheet of EVA (Ethylene

Vinyl Acetate) foam 110 as shown in Figure 5, preferably Phylon®, having a uniform thickness, and pre-cutting sheet 110 to a desired contour. The one-piece components may also be made of polyolefin foam or polyurethane foam. A non-uniform thickness sheet of EVA foam 110 may also be used to obtain various mechanical properties of the foam quarter panels. As illustrated in Figure 2, a protective textile overlay 44 is laminated onto the outer surface of the foam quarter panels preferably prior to the quarter panel being molded or after the foam quarter panels has been molded. The protective overlay 44 is a synthetic material, which is resistive to abrasion and cutting. A preferred material is nylon.

The pre-cut sheet of EVA foam with its protective overlay 44 is then inserted into the cavity of a male-female mold 100 as shown in Figure 4. The male portion 102 of mold 100 defines the interior surface 34 of the foam quarter panels whereas the female portion 104 of mold 100 defines its exterior surface. As illustrated, male portion 102, which defines the interior surface 34, is smooth and is shaped to generally conform to the morphology of a typical foot and ankle. Female portion 104 defines the outer surface of the foam quarter panels and as such can have numerous variations of designs to vary the mechanical properties of the foam quarter panels and to incorporate decorative features.

The pre-cut foam sheet 110 is aligned and temporarily secured to one of the mold portions 102 or 104 using any suitable means to accurately position pre-cut foam sheet 110 within mold 100 and maintain sheet 110 in position when mold 100 is closed. Once mold 100 is closed over pre-cut foam sheet 110, mold 100 is heated up to the thermoforming temperature of the foam and male and female portions 102 and 104 are pressed against the foam sheet 110. In a preferred embodiment of the invention, heat and pressure are applied simultaneously for a period of 8 to 10 minutes after which mold 100 is allowed to cool down so that the foam sheet 110 will set to the three-dimensional shape defined by the cavity of mold 100. When heat and pressure are applied to foam sheet 110, the foam

material originally in the thin area of the quarter panel tends to migrate to the thicker area of the quarter panel, thereby marginally increasing the density of the foam in the thicker area. Prior to removing the foam quarter panel from mold 100, mold 100 is cooled down for a period of time which is long enough for foam quarter panel to set and retain its new shape once removed. Upon removal, excess material of the initial foam sheet 110 remaining along the edges of the molded article is trimmed off as required to define the foam quarter panel as illustrated in Figures 1 and 2.

In the molding process described above, the applied heat is generally between 250°F and 350°F, with the preferred temperature being approximately 300°F. The applied pressure is generally between 50psi and 150psi, with the preferred pressure being approximately 100psi. The heat and pressure are applied for approximately 10 minutes and then the heat is turned off while maintaining minimal pressure to allow cooling of mold 100 so that the foam quarter panel will set in its new three-dimensional shape.

Skate boot 20 is designed to have stiffness variations in localized regions of upper 21. As described, the variation of stiffness of skate boot 20 is obtained at least partially by the use of preformed molded foam quarter panels. By utilizing different grades of foam material, different foam materials, the same foam material with different density, or the same foam material with different quantities in localized regions, the designers are able to vary, within a certain range, the mechanical properties of the molded quarter panels. The variation of stiffness or mechanical properties of the molded quarter panels directly affects the dynamic behavior of skate boot 20. As a further benefit of the molded foam panels, decorative or ornamental features such as ribs 42 may easily be added to the design providing more artistic flexibility to the designers.

Referring to Figure 6, as a variant of the present invention, the mechanical properties of the foam quarter panels may be locally modified by positioning additional layers of foam sheets 112 of different densities in strategic areas and then heating and compressing as described above. There are several options for varying the mechanical properties of the foam quarter panels to meet particular conditions. For instance, sheet 110 may also be provided with thinner portions to provide localized changes in the stiffness of the molded foam quarter panels. A thinner portion of foam material provides a softer area for greater flexibility.

Referring to Figure 7 and 8, the first structural elements of upper 21 consists of lateral and medial preformed foam quarter panels 22 and 24. Upper 21 is constructed by first combining quarter panels 22 and 24 together along a vertical line 45. Quarter panels 22 and 24 are preferably bridged together by means of zigzag, crossed stitching or any other suitable bridging means. As illustrated in figures 8a,b and c, quarter panels 22 and 24 may be either abutting together as shown in Figure 8a, overlapping each other as shown in Figure 8b, or joined together by a rear link 48 which is either sewn or glued to each quarter panels 22 and 24 as shown in Figure 8c.

As illustrated in Figure 8d, lateral and medial preformed foam quarter panels 22 and 24 may also be molded into a one-piece component thereby avoiding the combining step of the construction of upper 21 so that the bridging means is integral with each quarter panels. A larger male-female mold consisting of two side by side cavities similar to mold 100 laid flat and linked together at the thin region 36 forming the rear portion of skate boot 20 may be used. The preformed molded panels removed from the mold are simply bent to shape at the thin region 36 forming the rear portion of skate boot 20. The dual cavity mold may also be also be angled inwardly such that minimal bending of the preformed molded panels is required to obtain the desired shape panels. Although more

complex, a dual cavity mold as described further reduces the number of steps required to produce upper 21.

Referring now to Figures 9 and 10, once quarter panels 22 and 24 are combined and define the main structural component of upper 21, a first external layer of material in the form of a narrow band 56 is sewn along a substantial portion of the periphery of quarter panels 22 and 24. Narrow band 56 extend from the front lower edge 58 of each quarter panel, along upper edge 37, up along the frontal portion 57 of ankle support 25 and around to the rear portion of ankle support 25. Narrow band 56 may be a continuous one piece-component integrally connected at the rear of ankle support 25 or it may be two separate bands 56. Narrow band 56 covers a substantial portion of peripheral thin region 36 of each quarter panel 22 and 24 and encircles the upper edge of the thicker more structural central portion 40 of each quarter panel 22 and 24.

A second layer of material in the form of a rear cover 60 is sewn or otherwise attached to the rear portion of upper 21. Rear cover 60 extends from the top of tendon guard 27 down to the bottom of heel counter 23 and covers any joining lines such as vertical line 45 (Fig. 8) that may be visible at the back of upper 21. Rear cover 60 also reinforces the rear portion of upper 21. A second rear cover 61 may be added to increase support or for ornamental purposes.

Subsequently, an inner lining 26 is preferably glued to the interior surface 34 or to at least the upper portion of the interior surface 34 covering the ankle support area 25. Inner lining 26 may also be glued to the interior surfaces of each foam quarter panel 22 and 24 prior to their assembly. An added strip of lining 54 is stitched over the separation line resulting therefrom when quarter panels 22 and 24 are assembled. Although not necessary since the preformed foam quarter panels are soft and therefore comfortable, some cushioning or padding may be added between the interior surface 34 of the foam quarter panels and inner lining



26 in the ankle area.

As in traditionally made skate boot, a reinforcement plastic insert (not shown) may be positioned between the foam quarter panels and inner lining 26 in the heel and ankle area of upper 21 in order to provide more support and rigidity in this general area.

Upper eyelets 52 are then punched into the three layers making up the frontal portions 57 of ankle support 25. The three layers consist of narrow band 56, the thin foam peripheral region 36 and inner lining 26. Once punched, the holes are reinforced by metallic rivets or any suitable means as is well known in the art of footwear construction. In the illustrated embodiment of Figure 9, upper eyelets 52 make up the upper portion of the lacing system of skate boot 20, but could also make up the horizontal edge 37, as we normally see on skate boots. A lace (not shown) first extends through each loop 50 in a criss-crossing path in an alternate pattern and then through each upper eyelet 52 in a similar alternate criss-crossing pattern. When the lace is tightened, the two-quarter panels are caused to come closer together.

A series of lace loops 50, in the form of flexible traction resistant straps, are sewn or otherwise attached to the interior surface of upper horizontal edge 37 of each quarter panels 22 and 24. Lace loops 50 make up the lower portion of the lacing system of skate boot 20. A lace (not shown) extends through each loop 50 in a criss-crossing path in an alternate pattern. When the lace is tightened, the two edges 37 of the quarter panels are caused to come closer together. Loops 50 are preferably sewn to the peripheral thin region 36 of each quarter panel (fig.1). As illustrated, the series of lace loops 50 are located inside each quarter, giving skate boot 20 a different look, the lower portion of the lacing system being less visible. It must be noted that lace loops 50 may easily be replaced by standard lace eyelets, which will perform the same function and

provide skate boot 20 with a more traditional look.

Referring to Figures 9a and 10a, there is shown a first variation of the construction of upper 21. Upper 21 is constructed with a one-piece quarter panel 200, illustrated in hatching lines, enclosing only the rear portion of skate boot 20. This one-piece component panel 200 is designed to enclose a portion or substantial portion of the general area of ankle support 25 or designed to enclose a portion or substantial portion of heel counter 23 or to enclose the entire rear portion of skate boot 20. Panel 200 is made of preformed foam material molded to a definitive shape as described above. Panel 200 is sewn to front portions 202 on each side of upper 21 which are made of conventional material such as leather, vinyl, nylon etc. In the illustrated example, heel reinforcement 204 is sewn to the lower portion of Panel 200. Front portion 202 extends upwardly into a narrow band 206 along the front of ankle support 25 and covers the upper margin 208 of tendon guard 27. Panel 200 provides the necessary support and flexibility to the rear portion of skate boot 20.

Figures 9b and 10b illustrate a further variation of the rear panel. In the illustrated example, panel 210 encloses and covers the entire rear portion of upper 21 including heel counter 23, ankle support 25 and a portion of tendon guard 27. Panel 210 is sewn to front portions 212 on each side of upper 21 which are made of conventional material and cover a substantial portion of the front of skate boot 20.

Conversely, as illustrated in Figures 9c and 10c, the rear portion of upper 21 may be made of conventional material while a substantial portion of each side of skate boot 20 is made of preformed molded foam material. The rear portion of upper 21 including heel counter 23, ankle support 25 and tendon guard 27 is made of a first layer 215 of conventional material reinforced with a second layer 216 of conventional material covering tendon guard 27 and extending down to

heel counter 23. The first layer 215 extends along the upper edges 37 of each side of upper 21. Preformed molded quarter panels 218 and 220 are sewn into first layer 215 and complete each side of upper 21. Preformed molded quarter panels 218 and 220 provide support and flexibility to the sides of skate boot 20.

As a further variant of skate boot 20, it is possible to use a single preformed molded panel on only one side of the skate boot. This arrangement would provide two different types of support on either side of the skate boot.

Referring to Figure 11, a tongue 28 and a toe box 30 are added to the construction shown in Figure 9. Preferably, toe box 30 and tongue 28 are pre-assembled prior to installing into upper 21. The frontal edge 62 of tongue 28 is sewn directly to toe box 30 at stitching line 64, and then both sides of toe box 30 are sewn to each quarter panels 22 and 24 and to narrow band 56 at stitching line 66. A specific toe box and tongue is shown in this embodiment, however, any type of toe box whether made of a rigid plastic, covered with a textile overlay, or a soft toe box can be used. Similarly, various types of tongue may be used. These are detail variations, which do not effect the general construction of the skate boot as outlined herein.

Referring now to Figure 12, a last 68 is inserted into the inside cavity of upper 21. A last is a three-dimensional shape of the inside cavity of skate boot 20 which enables upper 21 to maintain its shape when skirt 38 is folded to give upper 21 its final shape. Last 68 is inserted into upper 21 and insole 70 is positioned underneath last 68 inside skirts 38 as illustrated by arrows A and B of Figure 12. Once the assembly is completed, upper 21 is placed upside down into a lasting machine. Glue is first applied to the bottom surface of insole 70 along its periphery. Skirt 38 is then folded over last 68 onto the bottom surface of insole 70, using the lasting machine wipers. Once folded, skirt 38 is adhesively bonded to insole 70 by the glue that was previously laid on the

bottom surface of insole 70. Skirt 38 is further nailed or tacked all around insole 70 to provide the necessary mechanical grip to remove the pulling forces and allow the glue to properly set between skirt 38 and insole 70. Once skirt 38 is firmly attached to insole 70 and upper 21 has acquired its final shape, a light sanding of the folded skirt is performed to partially even the lower surface of upper 21 and provide a flat surface on which an outsole can be glued or nailed.

Alternatively, the shaping of upper 21 may be accomplished without the use of a last since the foam quarter panels 22 and 24 are already molded to the desired shape of skate boot 20. Foam quarter panels 22 and 24 may be designed with interlocking means adapted to securely connected each other as well as connected other components such as toe box 30 and tongue 28 to the frontal portion of foam quarter panels 22 and 24.

As illustrated in Figure 13, a rigid plastic outsole 32 is mounted to the bottom surface of upper 21 with adhesive or nails. Outsole 32 provides a rigid platform to further strengthen upper 21 and provides a solid member onto which a ground engaging means such as an ice blade holder 80 or an in-line roller chassis 82 can be mounted.

As shown in Figure 14 and 15, an ice blade holder 80 or an in-line roller chassis 82 may be mounted to skate boot 20. Fasteners such as rivets or screws are typically used to secure the ground engaging means to skate boot 20 although many other methods can be used as is well know in the field of ice skates and especially in-line roller skates.

By using the outlined construction method, substantial cost saving may be expected compared to the traditionally made stitched skate boot. Most of the possible cost saving is realized through the elimination of pattern pieces and various components assembly. Using preformed molded quarter panels made

of variable thickness foam material instead of conventional textile and stitched together in a multi-layer construction, results in a substantial reduction of the number of parts to be assembled and therefore of the labor involved. Furthermore, the use of preformed molded quarter panels allows for greater flexibility in design modifications and in performance requirement changes. The thickness, density and design features of the preformed molded quarter panels may be modified while leaving the contours essentially unchanged so that a new preformed molded quarter panel may be introduced into the production of the skate boot without adding steps of the construction method or additional pieces to the construction. The use of preformed molded quarter panels allows the designers to include ornamental features to the skates without adding pieces as is usually done in traditionally made skates. It is also worth noting that a foam quarter panel may be used to produce two or more skate sizes. For example, the same quarter panel may be used to produce a size 9 or a size 9½; the variation being taken by the adjacent covering pieces such as narrow band 56 and rear covers 60 and 61.

Reference is now made to Figure 14. In use, preformed molded quarter panels 22 and 24 provide lateral support as well as resistance to forward flexing of skate boot 20. During the power stroke of a skater (skater's ankle flexes forward), a compression of the foam material occurs in the frontal area 91 as well as in the front ankle area 92 of each quarter panel whereas an extension or stretching of the foam material occurs in back portion 93. The resistance to flexing mostly occurs in the thicker central portion 40 of each quarter panels. The inherent elastic behavior of the foam material of the quarter panels provides a springing action or energy return effect to skate boot 20 as the skater completes the power strokes. The elastic property of the foam quarter panels tend to help the skater in the last phase of the power stroke by giving back some of the energy that was used to flex or bend the foam quarter panels at the beginning of the power stroke. The amount of lateral support and resistance to forward flexing as well

as springing action of the quarter panels varies depending upon the choice of the foam density, grade, quantity and layers as previously described.

The elastic behavior of the foam material of quarter panels 22 and 24 also prevents the formation of cracks or creases in the front ankle area 92. Traditionally made skate boots eventually develop cracks in this area as the textile material fatigues. Again, since the foam material of quarter panels 22 and 24 behave elastically, skate boot 20 does not fatigue as rapidly as traditionally made skate boots and exhibits a longer life cycle. Finally, the use of preformed foam quarter panels provides a skate boot made up of mostly absorbing material, which adjust itself to minor differences in foot and ankle morphology. This creates a very comfortable skate boot.

The above description of preferred embodiments should not be interpreted in a limiting manner since other variations, modifications and refinements are possible within the spirit and scope of the present invention. The scope of the invention is defined in the appended claims and their equivalents.

**The embodiments of the invention for which an exclusive privilege or property is claimed are defined as follows:**

1. A skate boot having an upper for enclosing and supporting a human foot, said upper comprising:
  - a heel counter for surrounding the sides and back of the heel portion of a human foot;
  - an ankle support for surrounding and supporting the ankle region of a human foot;
  - a medial quarter and a lateral quarter for enclosing each side of a human foot, each quarter having a frontal edge, said medial and lateral quarters extending forwardly from said heel counter and said ankle support; said quarters defining respective medial and lateral side of said skate boot;
  - bridging means for joining said quarters together at said heel counter and said ankle support;
  - an insole forming the bottom of said upper;
  - a toe box for covering the toe area of the human foot, said toe box connected to said frontal edges of said lateral and medial quarters;
  - a tongue extending upwardly and rearwardly from said toe box for covering the upper frontal part of the human foot and ankle; and
  - a rigid outsole defining the under side of said skate boot;
  - wherein at least one of said lateral and medial quarters consists of a preformed molded panel made of foam material having an inner surface and an outer surface wherein the inner surface of said panel is shaped to substantially conform to the anatomical shape of a corresponding side of the human foot.
2. A skate boot as defined in claim 1 wherein each said lateral quarter and medial quarter comprises a preformed molded panel made of foam material having an inner surface and an outer surface wherein the inner

surface of said panel is shaped to substantially conform to the anatomical shape of a corresponding side of the human foot.

3. A skate boot as defined in claim 2 wherein each said preformed molded panel is shaped to a definitive shape.
4. A skate boot as defined in claim 3 wherein each said preformed molded panel comprises varying thickness at selected regions.
5. A skate boot as defined in claim 4 wherein each said preformed molded panel comprises a central structural portion of predetermined thickness and a thinner peripheral region.
6. A skate boot as defined in claim 5 wherein the outer surfaces of said preformed molded panels comprise a protective textile overlay made of synthetic material resistive to abrasion and cutting.
7. A skate boot as defined in claim 6 further comprising ornamental patterns molded onto said outer surface of said central structural portion of said preformed molded panel.
8. A skate boot as defined in claim 2 wherein said preformed molded panels are made of a homogenous foam material.
9. A skate boot as defined in claim 2 wherein said preformed molded panels are made of layers of different grades of foam material.
10. A skate boot as defined in claim 2 wherein said preformed molded panels are made of foam material with different quantities in localized regions.



11. A skate boot as defined in claim 2 wherein said lateral and medial foam quarter panels are integrally connected together.
12. A skate boot as defined in claim 2 wherein said lateral and medial foam quarter panels are sewn together at a back portion of said skate boot upper.
13. A skate boot as defined in claim 1 further comprising lacing loops disposed in the lower portion of said medial quarter and said lateral quarter.
14. A skate boot as defined in claim 2 further comprising a first external layer of material in the form of a narrow band covering a portion of a periphery of said quarter panels.
15. A skate boot as defined in claim 2 further comprising a rear cover securely attached to the rear portion of said upper.
16. A skate boot having an upper for supporting and enclosing a human foot, said upper comprising:
  - a heel counter for surrounding the sides and back of the heel portion of a human foot;
  - an ankle support for surrounding and supporting the ankle region of a human foot;
  - a medial quarter and a lateral quarter for enclosing each side of a human foot, each quarter having a frontal edge, said medial and lateral quarters extending forwardly from said heel counter and said ankle support; said quarters defining respective medial and lateral side of said skate boot;
  - an insole forming the bottom of said upper;

- a toe box for covering the toe area of the human foot, said toe box connected to said frontal edges of said lateral and medial quarters;
- a tongue extending upwardly and rearwardly from said toe box for covering the upper frontal part of the human foot and ankle; and
- a rigid outsole defining the under side of said skate boot;
- wherein at least a substantial portion of said upper comprises a preformed molded element made of thermo-formable foam material shaped to a definitive shape.

17. A skate boot as defined in claim 16 wherein at least a substantial portion of said ankle support is made of thermo-formable foam material.
18. A skate boot as defined in claim 16 wherein at least a substantial portion of said heel counter is made of thermo-formable foam material.
19. A skate boot as defined in claim 16 wherein at least a substantial portion of said heel counter and of said ankle support is made of thermo-formable foam material.
20. A skate boot as defined in claim 16 wherein at least a substantial portion of said medial quarter and said lateral quarter is made of thermo-formable foam material.
21. A method of making a skate boot comprising the steps of:
  - (a) forming a foam quarter panel by molding a sheet of foam material;
  - (b) assembling to said foam quarter panel, an inner lining, an insole, a toe box and a tongue to form a skate boot upper; and
  - (c) affixing an outer sole to the under side of said skate boot upper.

22. A method of making a skate boot as defined in claim 21 wherein two foam quarter panels are formed by molding sheets of foam material, one medial foam quarter panel and one lateral foam quarter panel, said foam quarter panels being assembled together at the rear prior to the step of assembling to said foam quarter panels, an inner lining, an insole, a toe box and a tongue to form a skate boot upper.
23. A method of making a skate boot as defined in claim 22 wherein the step of assembling said foam quarter panels is accomplished by interlocking means adapted to securely connect said foam quarter panels together.
24. A method of making a skate boot as defined in claim 21 wherein said skate boot upper further comprises a lower skirt; the method further comprising the steps of:
  - (i) positioning said skate boot upper over a last;
  - (ii) shaping over the last said skate boot upper by folding said lower skirt of said upper underneath said insole and fastening said skirt to said insole;prior to affixing an outer sole to the under side of said skate boot upper.
25. A method of making a skate boot as defined in claim 21 wherein the step of forming a foam quarter panel by molding a sheet of foam material comprises the steps of:
  - (a) positioning the sheet of foam material into a male-female mold and closing the mold;
  - (b) applying heat and pressure to said sheet of foam material;
  - (c) thermoforming at least a portion of said sheet of foam material to the shape of said male-female mold;

(d) cooling said portion of said sheet of foam material in a compressed state so that said portion of said sheet of foam material sets in the shape of said male-female mold; and

(e) opening said male-female mold and removing the molded foam quarter panel from said mold.

26. A method of making a skate boot as defined in claim 25 further comprising the step of affixing a protective textile overlay made of synthetic material resistive to abrasion and laceration over said sheet of foam material prior to forming said foam quarter panel.
27. A method of making a skate boot as defined in claim 25 further comprising the step of providing an exterior layer of material over said foam quarter panel to form the exterior surface of said foam quarter panel.
28. A method of making a skate boot as defined in claim 25 further comprising positioning an additional element of foam material over said sheet of foam material prior to said step of applying heat and pressure, thereby molding the additional element simultaneously.
29. A method of making a skate boot as defined in claim 21 further comprising positioning a padding element in between said inner lining and said foam quarter panel.
30. A skate boot having an upper for enclosing and supporting a human foot, said upper comprising:
  - a heel counter for surrounding the sides and back of the heel portion of a human foot;

- an ankle support for surrounding and supporting the ankle region of a human foot;
- a medial quarter and a lateral quarter for enclosing each side of a human foot, each said quarter having a frontal edge, said medial and lateral quarters defining respective medial and lateral side of said upper and together defining said heel counter and said ankle support; said lateral and medial quarters comprising a preformed molded panel made of foam material having an inner surface and an outer surface wherein the inner surface of said panel is shaped to substantially conform to the anatomical shape of a corresponding side of the human foot;
- bridging means for joining said quarters together at said heel counter and said ankle support;
- an insole forming the bottom of said upper;
- a toe box for covering the toe area of the human foot, said toe box connected to said frontal edges of said lateral and medial quarters;
- a tongue extending upwardly and rearwardly from said toe box for covering the upper frontal part of the human foot and ankle; and
- a rigid outsole defining the under side of said skate boot.

31. A skate boot as defined in claim 30 further comprising a layer of conventional material attached to a substantial portion of the periphery of said preformed molded panel.
32. An ice skate comprising a skate boot as defined in claim 1 and an ice blade holder secured to the bottom of said rigid outsole.
33. An in-line roller skate comprising a skate boot as defined in claim 1 and an in-line roller chassis secured to the bottom of said rigid outsole.

34. An ice skate comprising a skate boot as defined in claim 16 and an ice blade holder secured to the bottom of said rigid outsole.
35. An in-line roller skate comprising a skate boot as defined in claim 16 and an in-line roller chassis secured to the bottom of said rigid outsole.

### **ABSTRACT**

A skate boot for ice skate or in-line roller skate comprising an upper having portions thereof made of compressed foam material. In a preferred embodiment, the skate boot is constructed with two preformed quarter panels made of compressed foam material having wherein the inner surface of each panel is shaped to substantially conform to the anatomical shape of a corresponding side of the human foot. Such a construction provides a skate boot, which is comfortable, long lasting, and exhibits flexibility and support. Such a construction also provides added flexibility to the skate designers to vary the dynamic properties of the skate and also the ornamental features of the skate. A method of making such a skate boot is also disclosed.

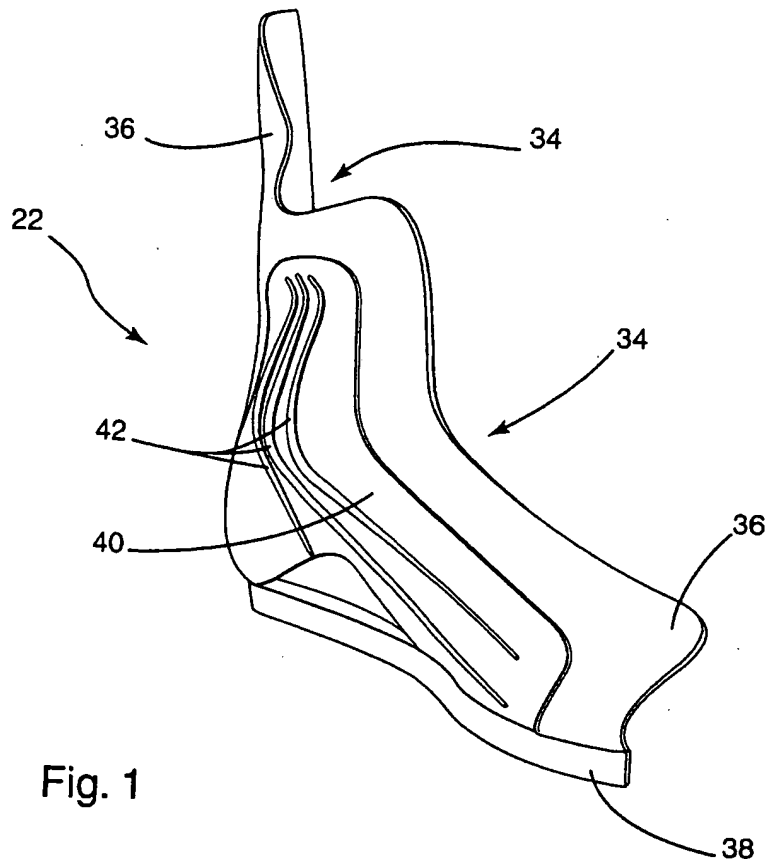


Fig. 1

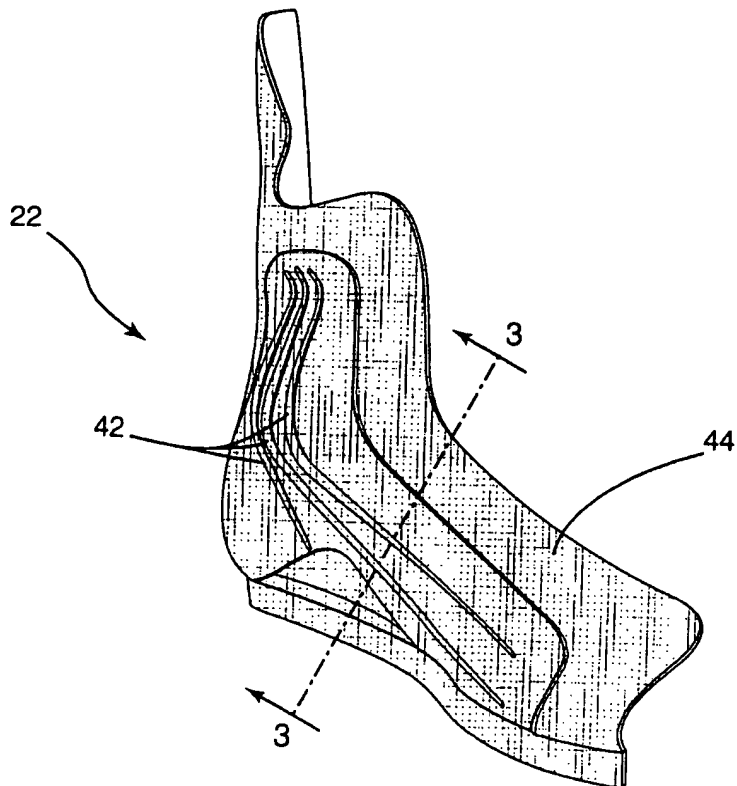


Fig. 2

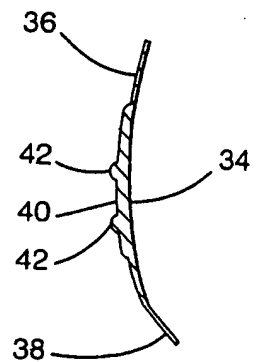


Fig. 3



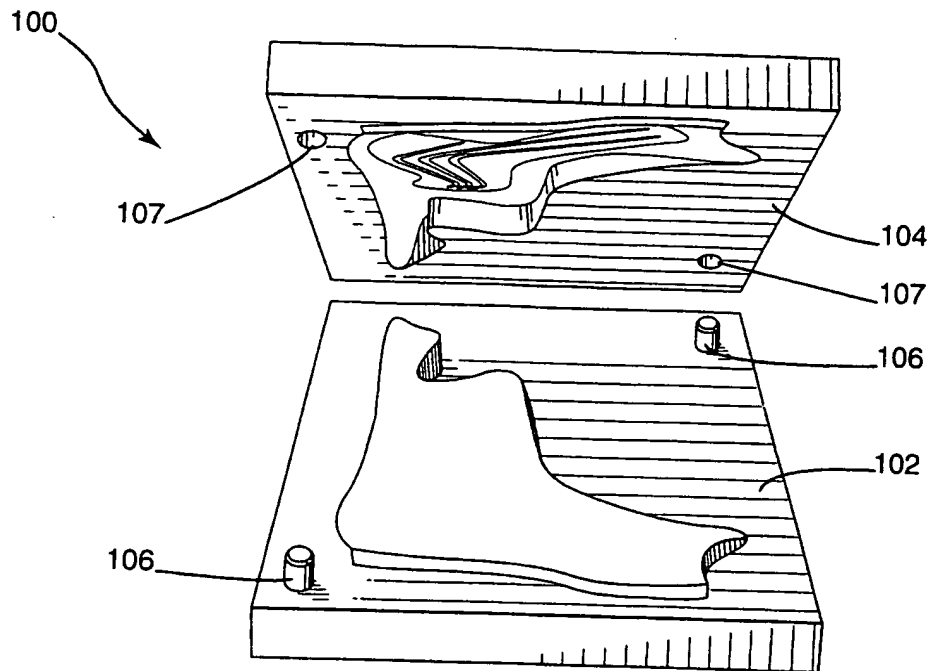


Fig. 4

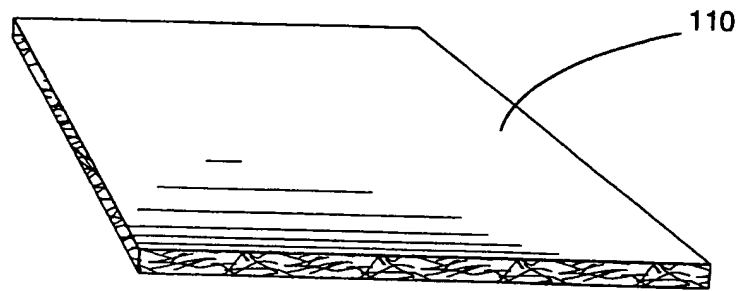


Fig. 5

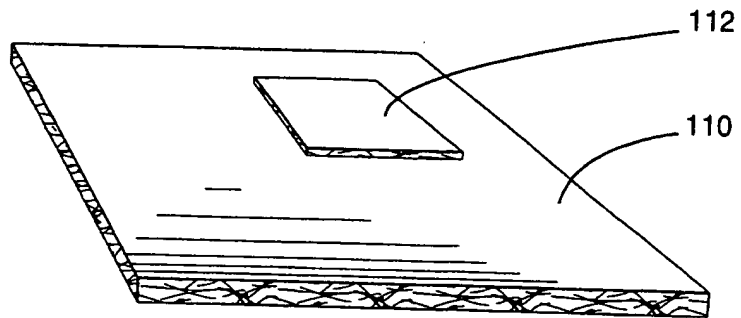


Fig. 6

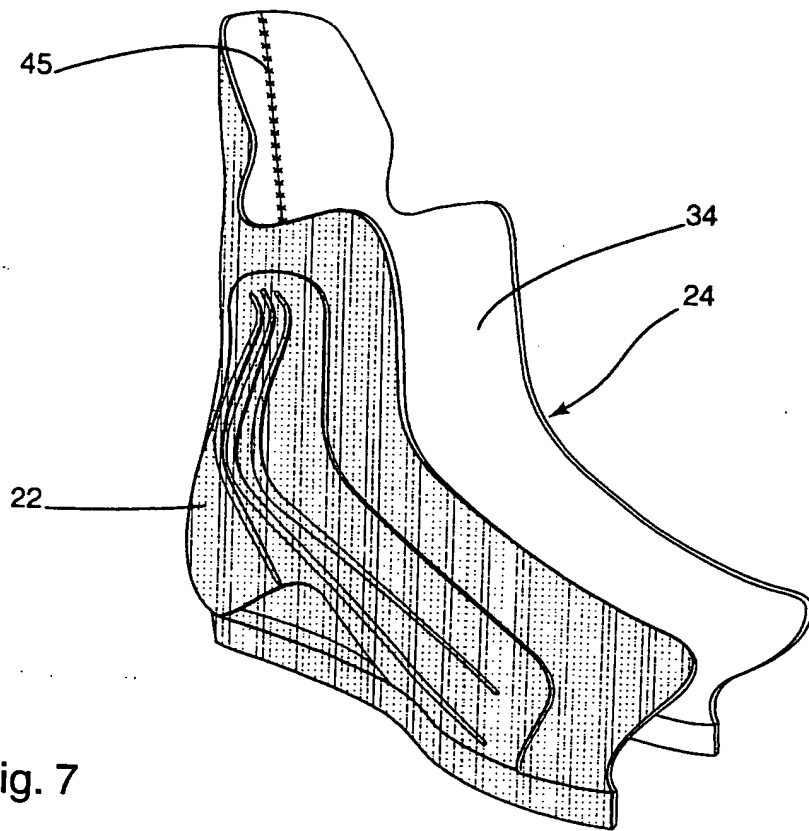


Fig. 7

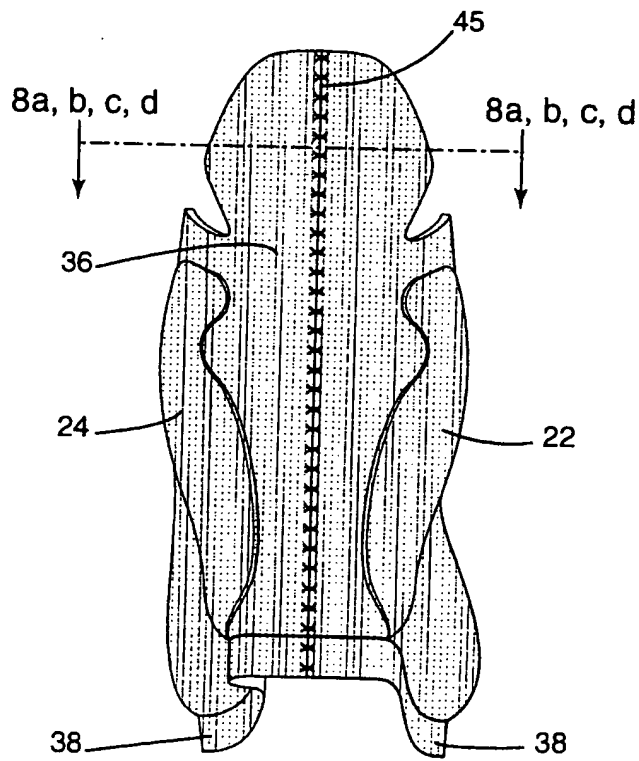


Fig. 8



Fig. 8a



Fig. 8b

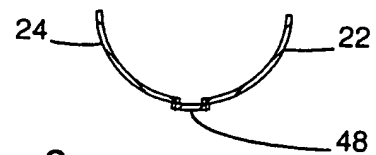


Fig. 8c



Fig. 8d

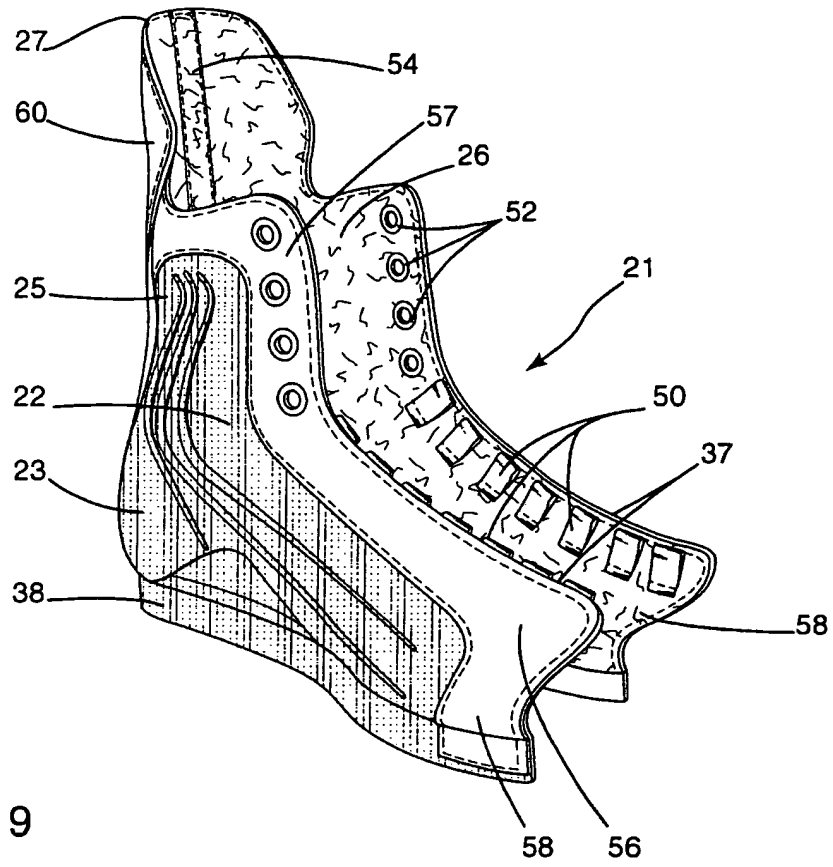


Fig. 9

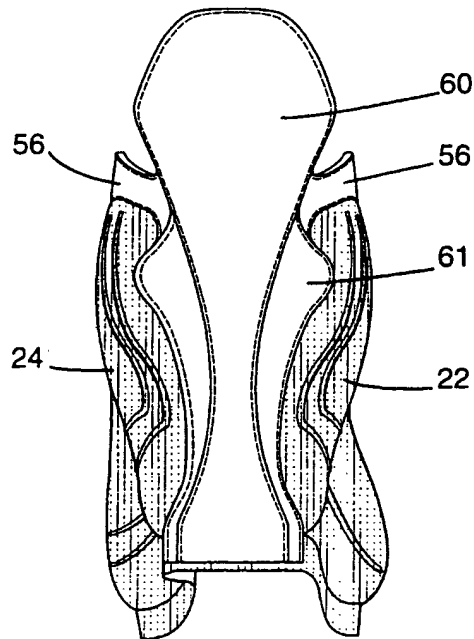


Fig. 10

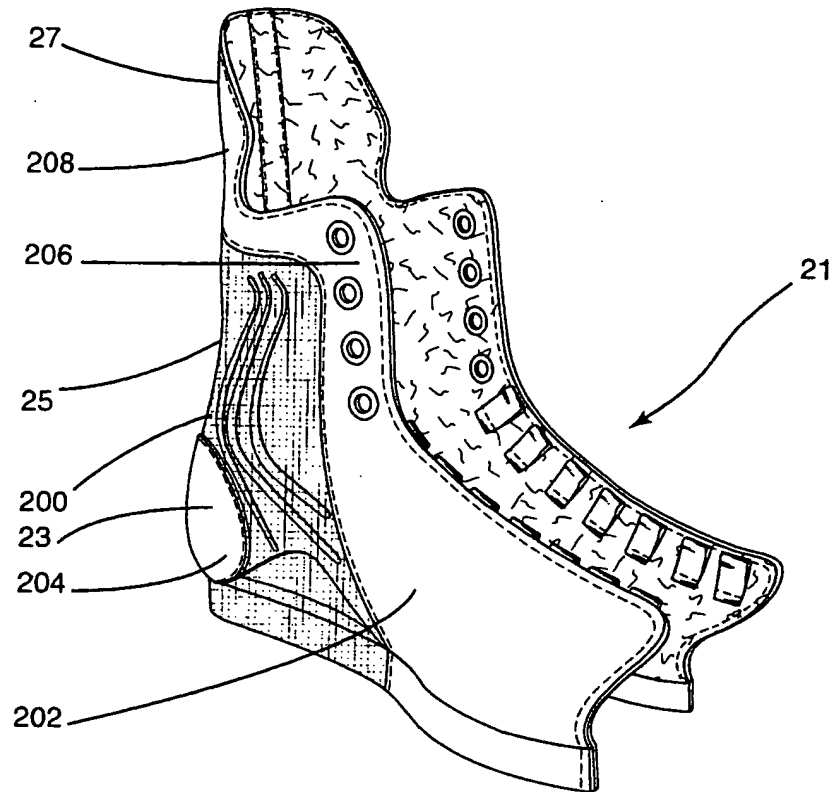


Fig. 9a

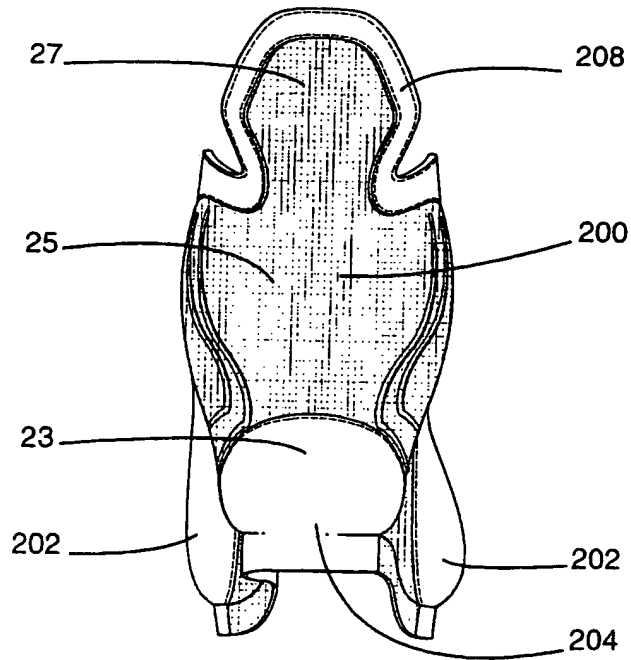


Fig. 10a

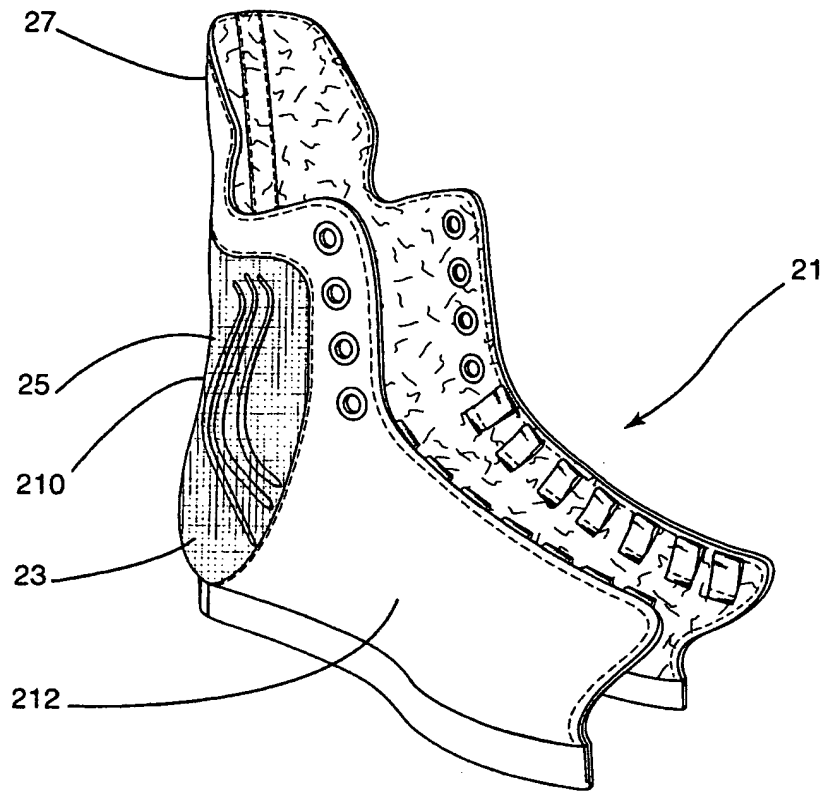


Fig. 9b

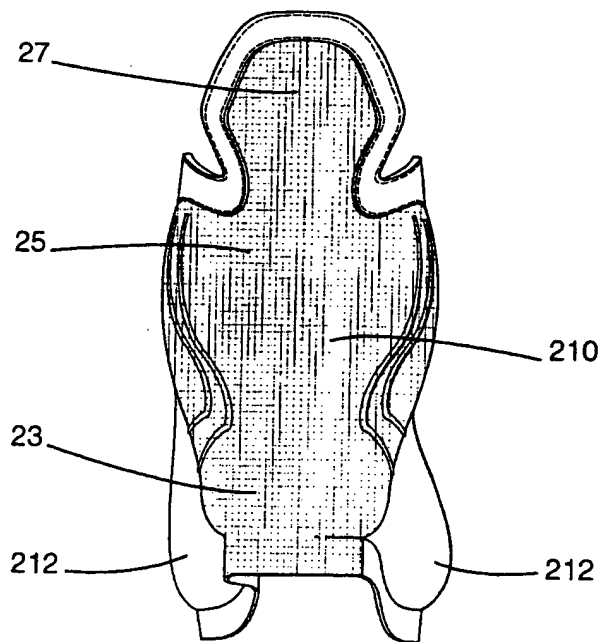


Fig. 10b

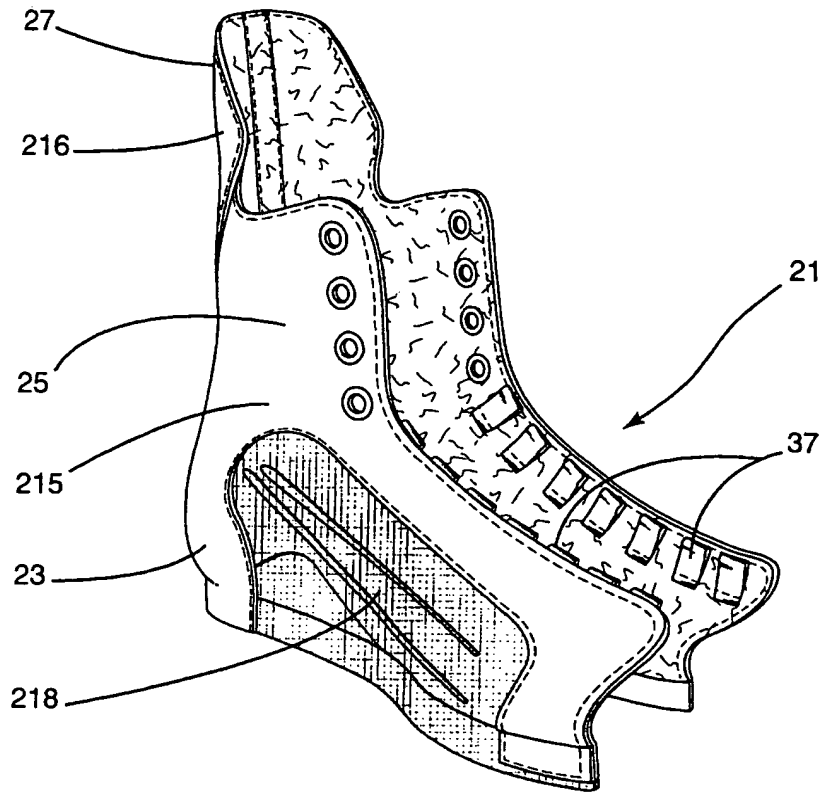


Fig. 9c

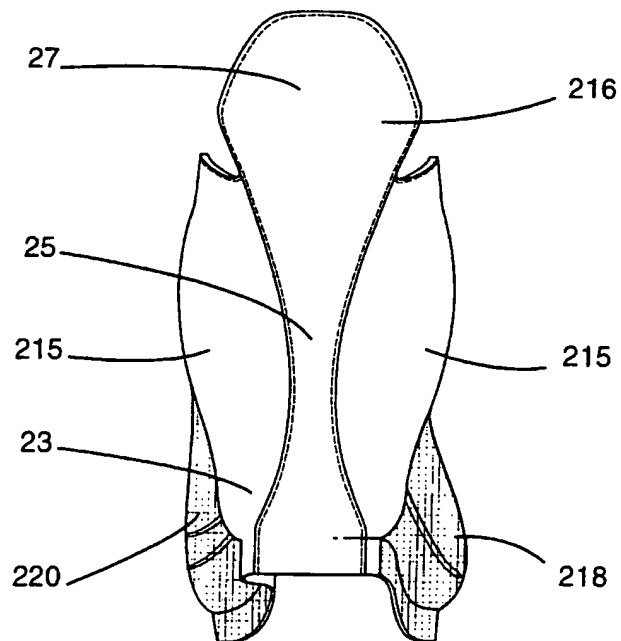


Fig. 10c

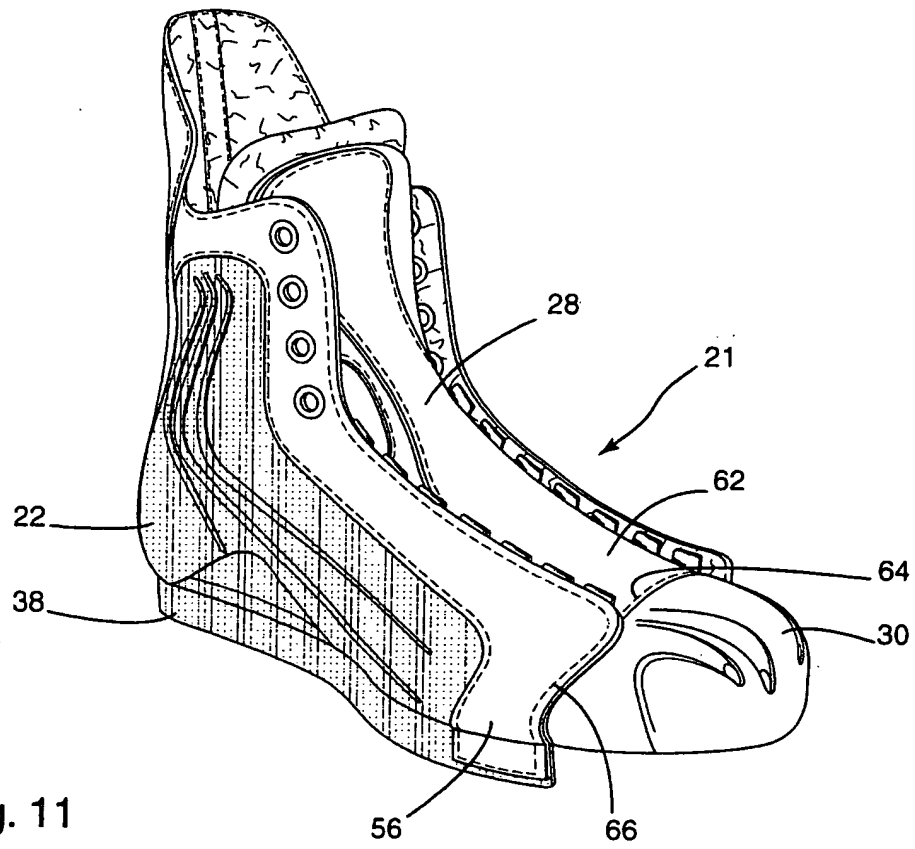


Fig. 11

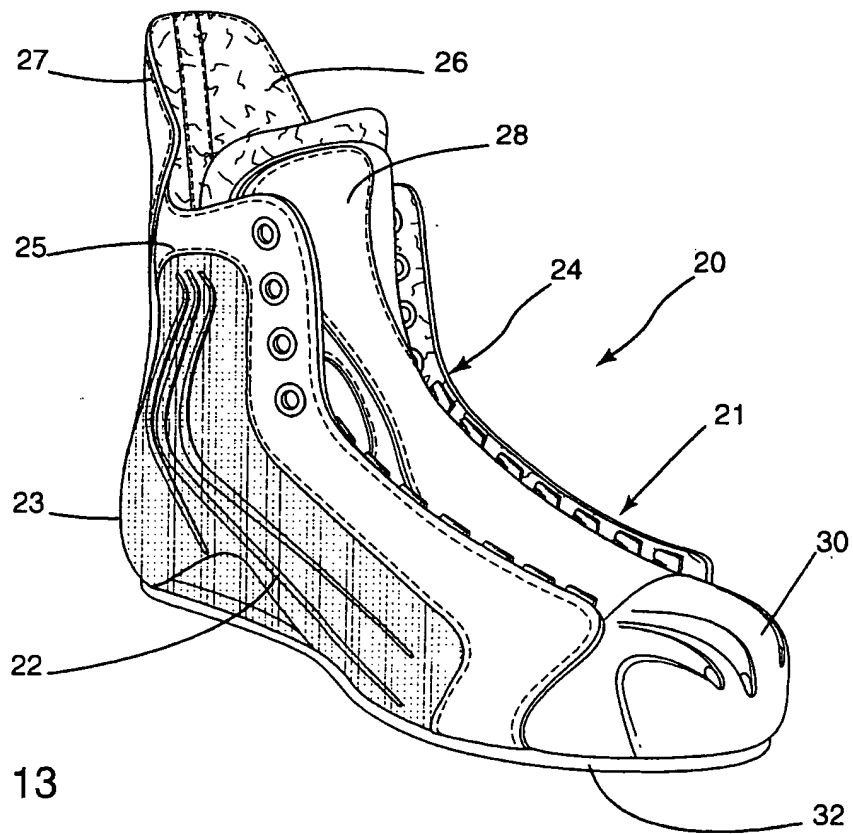


Fig. 13

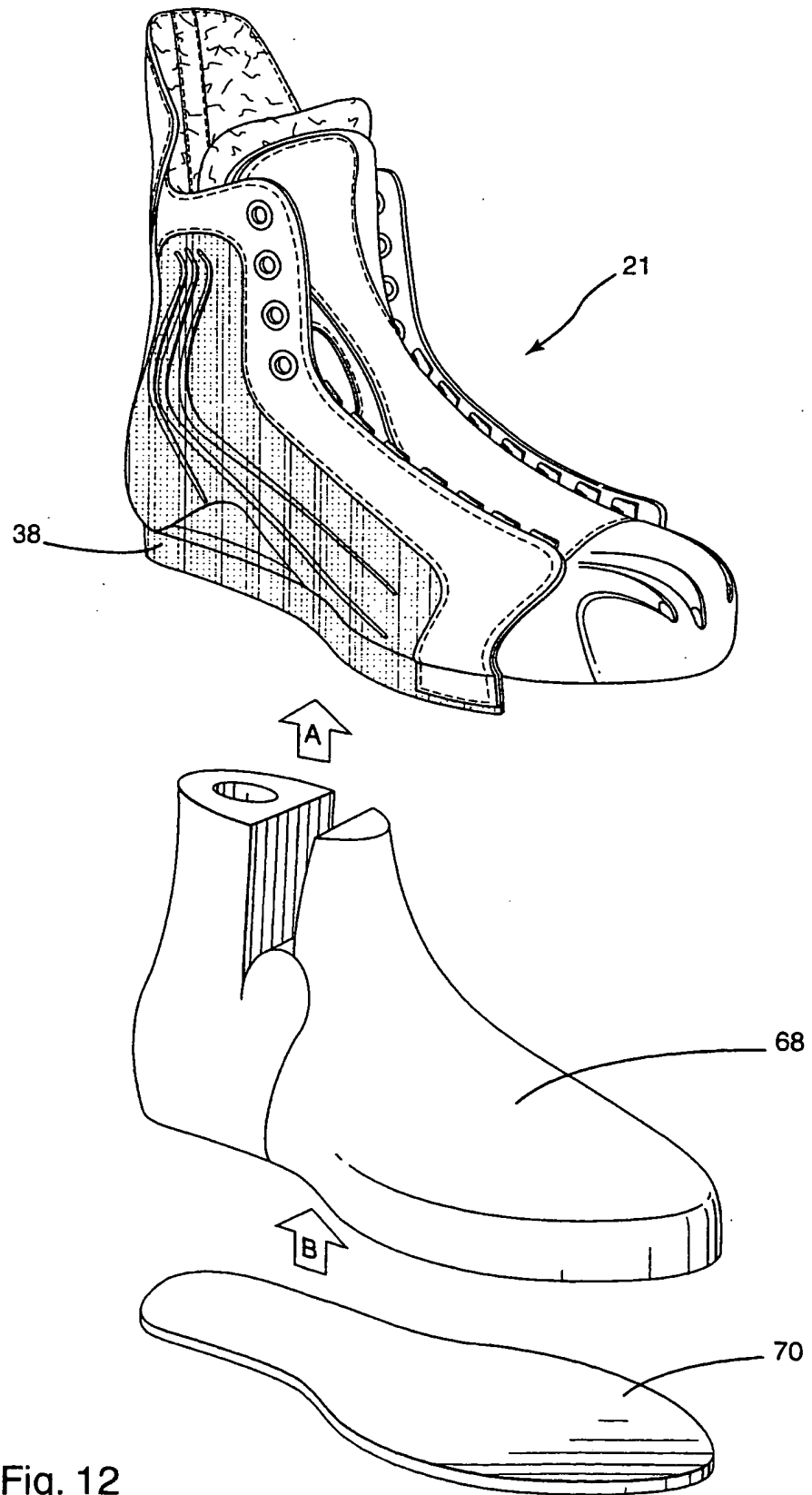


Fig. 12



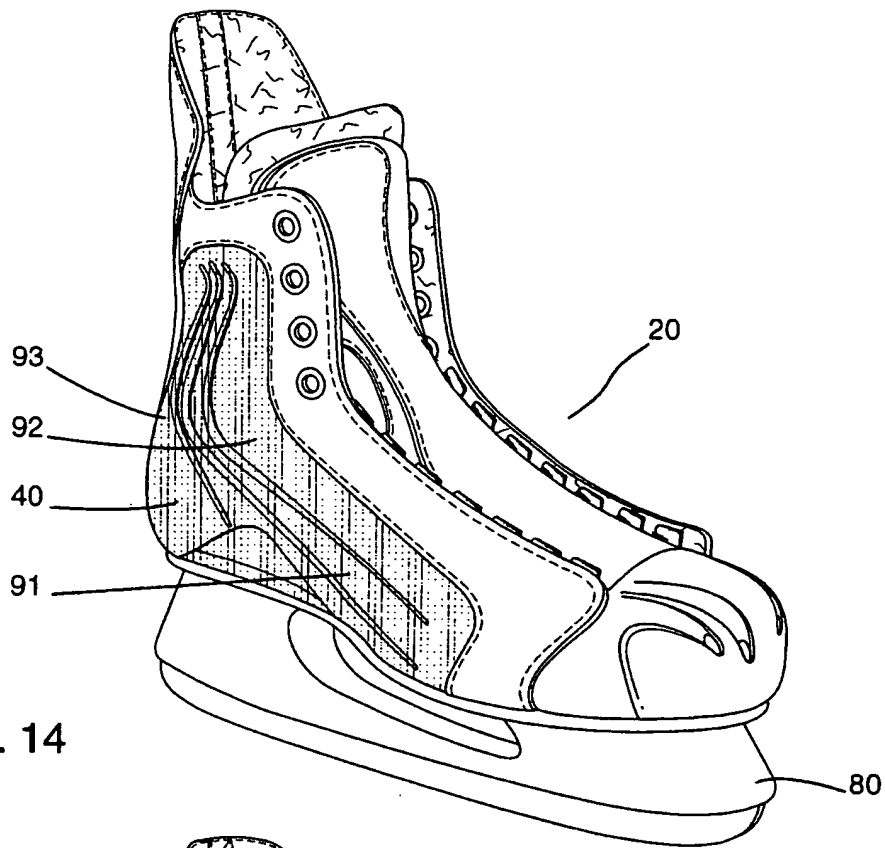


Fig. 14

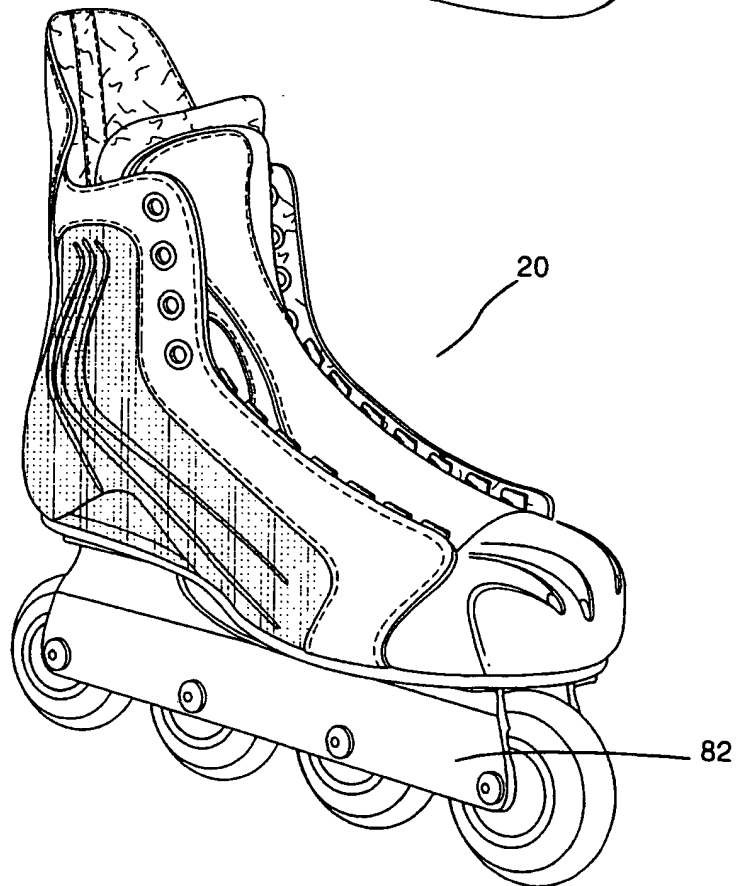


Fig. 15